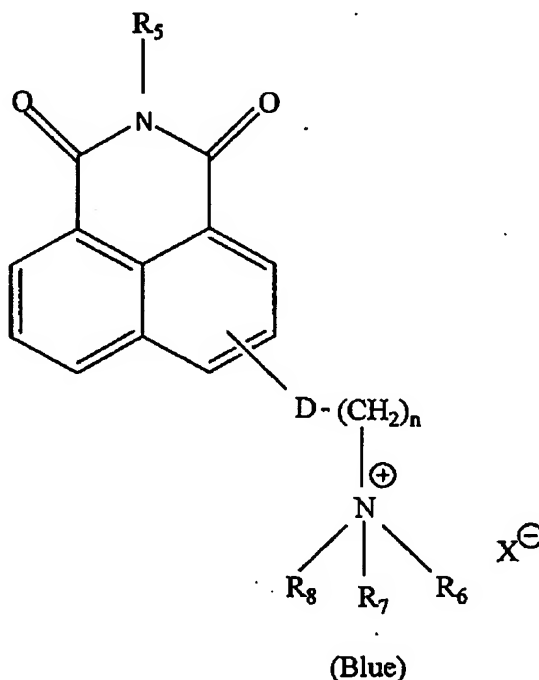


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CLAIMS

1. (Currently amended) A water-soluble fluorescent monomer that contains at least one vinyl group and at least one quaternary amine group in the molecule, which is capable of free radical polymerization selected from the group consisting of compounds of the formulae:



wherein n is an integer, selected from the group consisting of 1-10;

R₆ and R₇ are alkyl;

R₈ is selected from the group consisting of allyl, vinylbenzyl and 2-hydroxy-3-allyloxy-propyl;

R₅ is selected from the group consisting of alkyl, alkylamino, hydroxyalkyl and allyl;

D is oxygen or nitrogen or sulfur or nonexistent; with the proviso that when D is nonexistent, (CH₂)_n is bonded directly to a carbon on the ring; and

X is an anionic counter ion;

the water-soluble fluorescent monomer being named

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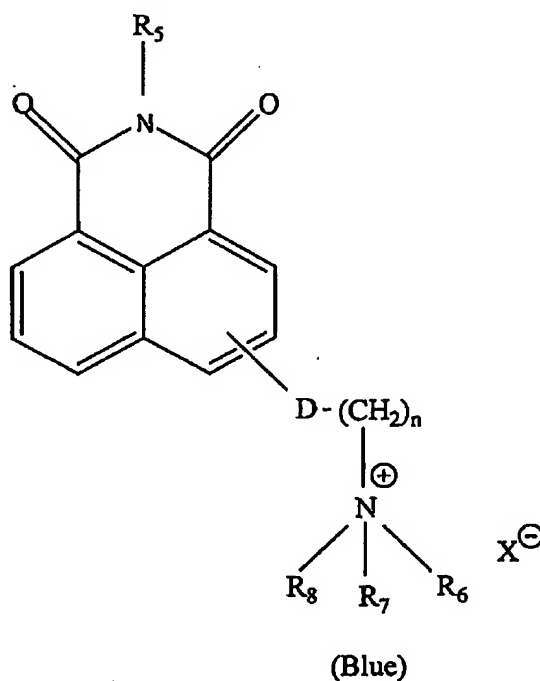
N-allyl-4-(2-N',N'-dimethylaminoethoxy)naphthalimide, methyl sulfate quaternary salt.

2. (Cancelled)

3. (Withdrawn) A tagged treatment polymer selected from the group consisting of:

(1) $G_n Q_j W_t$

wherein G is selected from the group consisting of:



wherein n is an integer, selected from the group consisting of 1-10;

R_6 and R_7 are alkyl;

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R₈ is selected from the group consisting of allyl, alkyl, vinylbenzyl and 2-hydroxy-3-allyloxy-propyl;

R₅ is selected from the group consisting of alkyl, alkylamino, hydroxyalkyl and allyl;

D is oxygen or nitrogen or sulfur or nonexistent; with the proviso that when D is nonexistent, (CH₂)_n is bonded directly to a carbon on the ring; and

X is an anionic counter ion;

wherein Q is selected from the group consisting of acrylic acid and salts thereof, methacrylic acid and salts thereof, maleic acid and salts thereof, maleic anhydride, , acrylamide, crotonic acid, acrylamidomethylpropane sulfonic acid and salts thereof;

wherein W is selected from the group consisting of:

acrylic acid and salts thereof, methacrylic acid and salts thereof, itaconic acid and salts thereof, maleic acid and salts thereof, maleic anhydride, crotonic acid and salts thereof, acrylamide, methacrylamide, vinyl sulfonic acid, styrene sulfonate, N-tertbutylacrylamide, N-isopropylacrylamide, butoxymethylacrylamide, N,N-dimethylacrylamide, N,N-diethylacrylamide, dimethylaminoethyl acrylate methyl chloride quaternary salts, dimethylaminoethyl acrylate benzyl chloride quaternary salts, dimethylaminoethyl acrylate methyl sulfate quaternary salt, dimethylaminoethyl methacrylate methyl sulfate quaternary salt, dimethylaminoethyl acrylamide methyl sulfate quaternary salts, dimethylaminopropyl acrylamide methyl sulfate quaternary salts, dimethylaminopropyl methacrylamide methyl sulfate quaternary salts, diallyldimethyl ammonium chloride, N-vinyl formamide, dimethylamino ethyl methacrylate acid salts (including, but not limited to, sulfuric acid and hydrochloride acid salts), dimethylaminoethyl methacrylate methyl chloride quaternary salt, dimethylaminoethyl methacrylate benzyl chloride quaternary salt, methacrylamidopropyl trimethyl ammonium chloride, acrylamidopropyl trimethyl ammonium chloride, methylene bis acrylamide, triallylamine, acid salts of triallylamine, ethylene glycol

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dimethacrylate, hydroxymethylacrylate, hydroxyethylacrylate, hydroxypropylacrylate, hydroxypropylmethacrylate, diethylene glycol dimethacrylate, triethylene glycol dimethylacrylate, polyethylene glycol dimethacrylate, glycidyl methacrylate, acrylamidomethylpropane sulfonic acid and the sodium salt thereof, vinyl alcohol, vinyl acetate, and N-vinylpyrrolidone;

with the proviso that Q and W cannot both be the same;

wherein a is from about 0.001 to about 10.0 mole percent;

wherein j is from about 0 to about 99.999 mole percent;

wherein t is from about 0 to about 99.999 mole percent; and

wherein $a + j + t = 100$;

(2) $G_a Q_v W_f S_c$

wherein G is as previously defined;

wherein Q is as previously defined;

wherein W is as previously defined, with the proviso that Q and W cannot both be the same;

wherein S is selected from the group consisting of sulfomethylacrylamide and sulfoethylacrylamide;

wherein a is from about 0.001 to about 10.00 mole percent;

wherein v is from about 0 to about 97.999 mole percent;

wherein f is from about 1 to about 97.999 mole percent;

wherein c is from about 1 to about 40 mole percent; and

wherein $a + v + f + c = 100$.

4. (Withdrawn) A tagged treatment polymer of Claim 3 wherein G is N-allyl-4-(2-N',N'-dimethylaminoethoxy)naphthalimide, methyl sulfate quaternary salt.

5. (Withdrawn) A tagged treatment polymer of Claim 3 wherein Q is

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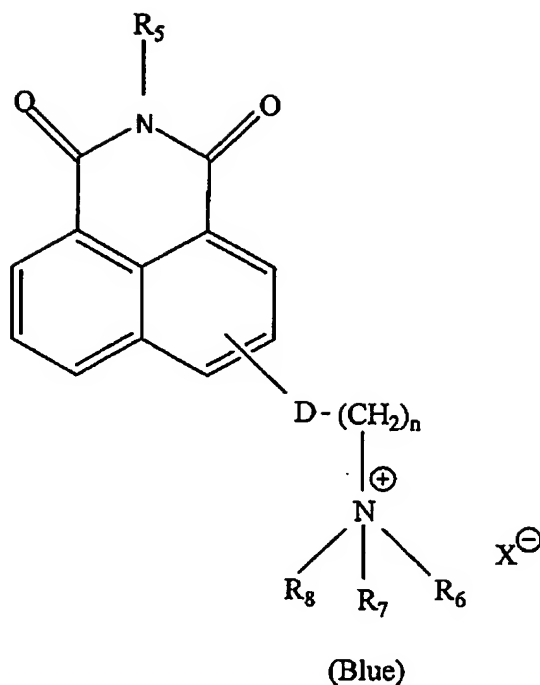
acrylic acid and W is acrylamide.

6. (Withdrawn) A tagged treatment polymer of Claim 3 wherein Q is acrylamide, W is acrylic acid and S is N-sulfomethylacrylamide.
7. (Withdrawn) A tagged treatment polymer of Claim 3 wherein Q is acrylic acid and W is acrylamidomethylpropane sulfonic acid.
8. (Withdrawn) A tagged treatment polymer of Claim 3 wherein G is N-allyl-4-(2-N',N'-dimethylaminoethoxy)naphthalimide, methyl sulfate quaternary salt, Q is acrylic acid, W is acrylamide and S is N-sulfomethylacrylamide.
9. (Withdrawn) A tagged treatment polymer of claim 3 wherein G is N-allyl-4-(2-N',N'-dimethylaminoethoxy)naphthalimide, methyl sulfate quaternary salt, Q is acrylic acid and W is acrylamidomethylpropane sulfonic acid.
10. (Withdrawn) A tagged treatment polymer of Claim 3 wherein G is N-allyl-4-(2-N',N'-dimethylaminoethoxy)naphthalimide, methyl sulfate quaternary salt, and Q is acrylic acid.
11. (Withdrawn) A process for the inhibition of scale formation in an industrial water system which comprises introducing into said industrial water system a tagged treatment polymer selected from the group consisting of:

(1) $G_a Q_j W_i$

wherein G is selected from the group consisting of:

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wherein n is an integer, selected from the group consisting of 1-10;

R₆ and R₇ are alkyl;

R₈ is selected from the group consisting of allyl, alkyl, vinylbenzyl and 2-hydroxy-3-allyloxypropyl;

R₅ is selected from the group consisting of alkyl, alkylamino, hydroxyalkyl and allyl;

D is oxygen or nitrogen or sulfur or nonexistent; with the proviso that when D is nonexistent, (CH₂)_n is bonded directly to a carbon on the ring; and

X is an anionic counter ion;

wherein Q is selected from the group consisting of acrylic acid and salts thereof, methacrylic acid and salts thereof, maleic acid and salts thereof, maleic anhydride, , acrylamide, crotonic acid, acrylamidomethylpropane sulfonic acid and salts thereof;

wherein W is selected from the group consisting of:

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acrylic acid and salts thereof, methacrylic acid and salts thereof, itaconic acid and salts thereof, maleic acid and salts thereof, maleic anhydride, crotonic acid and salts thereof, acrylamide, methacrylamide, vinyl sulfonic acid, styrene sulfonate, N-tertbutylacrylamide, N-isopropylacrylamide, butoxymethylacrylamide, N,N-dimethylacrylamide, N,N-diethylacrylamide, dimethylaminoethyl acrylate methyl chloride quaternary salts, dimethylaminoethyl acrylate benzyl chloride quaternary salts, dimethylaminoethyl acrylate methyl sulfate quaternary salt, dimethylaminoethyl methacrylate methyl sulfate quaternary salt, dimethylaminoethyl acrylamide methyl sulfate quaternary salts, dimethylaminopropyl acrylamide methyl sulfate quaternary salts, dimethylaminopropyl methacrylamide methyl sulfate quaternary salts, diallyldimethyl ammonium chloride, N-vinyl formamide, dimethylamino ethyl methacrylate acid salts (including, but not limited to, sulfuric acid and hydrochloride acid salts), dimethylaminoethyl methacrylate methyl chloride quaternary salt, dimethylaminoethyl methacrylate benzyl chloride quaternary salt, methacrylamidopropyl trimethyl ammonium chloride, acrylamidopropyl trimethyl ammonium chloride, methylene bis acrylamide, triallylamine, acid salts of triallylamine, ethylene glycol dimethacrylate, hydroxymethylacrylate, hydroxyethylacrylate, hydroxypropylacrylate, hydroxypropylmethacrylate, diethylene glycol dimethacrylate, triethylene glycol dimethylacrylate, polyethylene glycol dimethacrylate, glycidyl methacrylate, acrylamidomethylpropane sulfonic acid and the sodium salt thereof, vinyl alcohol, vinyl acetate, and N-vinylpyrrolidone;

with the proviso that Q and W cannot both be the same;

wherein a is from about 0.001 to about 10.0 mole percent;

wherein j is from about 0 to about 99.999 mole percent;

wherein t is from about 0 to about 99.999 mole percent; and

wherein $a + j + t = 100$;

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(2) $G_a Q_v W_f S_c$

wherein G is as previously defined;

wherein Q is as previously defined;

wherein W is as previously defined, with the proviso that Q and W
cannot both be the same;

wherein S is selected from the group consisting of sulfomethylacrylamide and
sulfoethylacrylamide;

wherein a is from about 0.001 to about 10.00 mole percent;

wherein v is from about 0 to about 97.999 mole percent;

wherein f is from about 1 to about 97.999 mole percent;

wherein c is from about 1 to about 40 mole percent; and

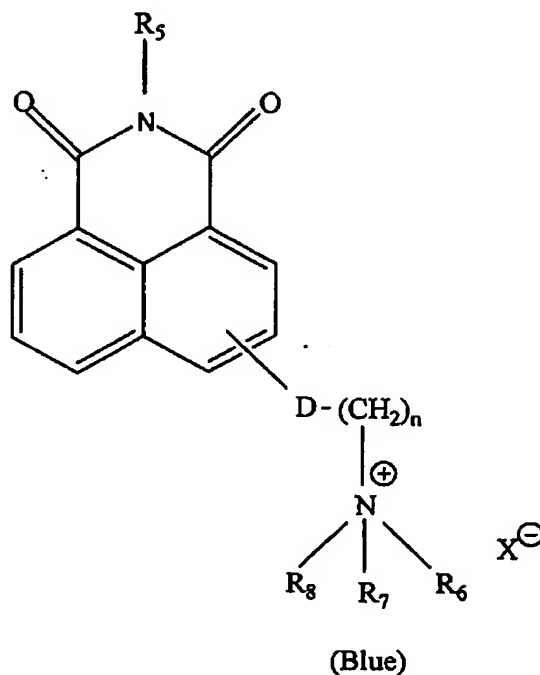
wherein $a + v + f + c = 100$;

in an amount sufficient to inhibit scale formation.

12. (Withdrawn) The process of Claim 11 wherein Q is acrylic acid and W is acrylamide.
13. (Withdrawn) The process of Claim 11 wherein Q is acrylamide, W is acrylic acid and S is N-sulfomethyl acrylamide.
14. (Withdrawn) The process of Claim 11 wherein Q is acrylic acid and W is acrylamidomethylpropane sulfonic acid.
15. (Withdrawn) The process of Claim 11 wherein G is N-allyl-4-(2-N',N'-dimethylaminoethoxy)naphthalimide, methyl sulfate quaternary salt, Q is acrylic acid, W is acrylamide and S is N-sulfomethylacrylamide.

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16. (Withdrawn) The process of Claim 11 wherein G is N-allyl-4-(2-N',N'-dimethylaminoethoxy)naphthalimide, methyl sulfate quaternary salt, Q is acrylic acid and W is acrylamidomethylpropane sulfonic acid.
17. (Withdrawn) The process of Claim 11 wherein G is N-allyl-4-(2-N',N'-dimethylaminoethoxy)naphthalimide, methyl sulfate quaternary salt and Q is acrylic acid.
18. (Withdrawn) A method for maintaining the desired amount of tagged treatment polymer in an industrial water system comprising the steps of:
- i) adding to said industrial water system a tagged treatment polymer, selected from a group consisting of:
- (1) $G_a Q_j W_l$
- wherein G is selected from the group consisting of:



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wherein n is an integer, selected from the group consisting of 1-10;

R₆ and R₇ are alkyl;

R₈ is selected from the group consisting of allyl, alkyl, vinylbenzyl and 2-hydroxy-3-allyloxypropyl;

R₅ is selected from the group consisting of alkyl, alkylamino, hydroxyalkyl, and allyl;

D is oxygen or nitrogen or sulfur or nonexistent; with the proviso that when D is nonexistent, (CH₂)_n is bonded directly to a carbon on the ring; and

X is an anionic counter ion;

wherein W is selected from the group consisting of:

acrylic acid and salts thereof, methacrylic acid and salts thereof, itaconic acid and salts thereof, maleic acid and salts thereof, maleic anhydride, crotonic acid and salts thereof, acrylamide, methacrylamide, vinyl sulfonic acid, styrene sulfonate, N-tertbutylacrylamide, N-isopropylacrylamide, butoxymethylacrylamide, N,N-dimethylacrylamide, N,N-diethylacrylamide, dimethylaminoethyl acrylate methyl chloride quaternary salts, dimethylaminoethyl acrylate benzyl chloride quaternary salts, dimethylaminoethyl acrylate methyl sulfate quaternary salt, dimethylaminoethyl methacrylate methyl sulfate quaternary salt, dimethylaminoethyl acrylamide methyl sulfate quaternary salts, dimethylaminopropyl acrylamide methyl sulfate quaternary salts, dimethylaminopropyl methacrylamide methyl sulfate quaternary salts, diallyldimethyl ammonium chloride, N-vinyl formamide, dimethylamino ethyl methacrylate acid salts (including, but not limited to, sulfuric acid and hydrochloride acid salts), dimethylaminoethyl methacrylate methyl chloride quaternary salt, dimethylaminoethyl methacrylate benzyl chloride quaternary salt, methacrylamidopropyl trimethyl ammonium chloride, acrylamidopropyl trimethyl ammonium chloride, methylene bis acrylamide, triallylamine, acid salts of triallylamine, ethylene glycol dimethacrylate, hydroxymethylacrylate, hydroxyethylacrylate, hydroxypropylacrylate,

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hydroxypropylmethacrylate, diethylene glycol dimethacrylate, triethylene glycol dimethylacrylate, polyethylene glycol dimethacrylate, glycidyl methacrylate, acrylamidomethylpropane sulfonic acid and the sodium salt thereof, vinyl alcohol, vinyl acetate, and N-vinylpyrrolidone;

with the proviso that Q and W cannot both be the same;

wherein a is from about 0.001 to about 10.0 mole percent;

wherein j is from about 0 to about 99.999 mole percent;

wherein t is from about 0 to about 99.999 mole percent; and

wherein $a + j + t = 100$;

(2) $G_a Q_v W_f S_c$

wherein G is as previously defined;

wherein Q is as previously defined;

wherein W is as previously defined, with the proviso that Q and W

cannot both be the same;

wherein S is selected from the group consisting of sulfomethylacrylamide and sulfoethylacrylamide;

wherein a is from about 0.001 to about 10.00 mole percent;

wherein v is from about 0 to about 97.999 mole percent;

wherein f is from about 1 to about 97.999 mole percent;

wherein c is from about 1 to about 40 mole percent; and

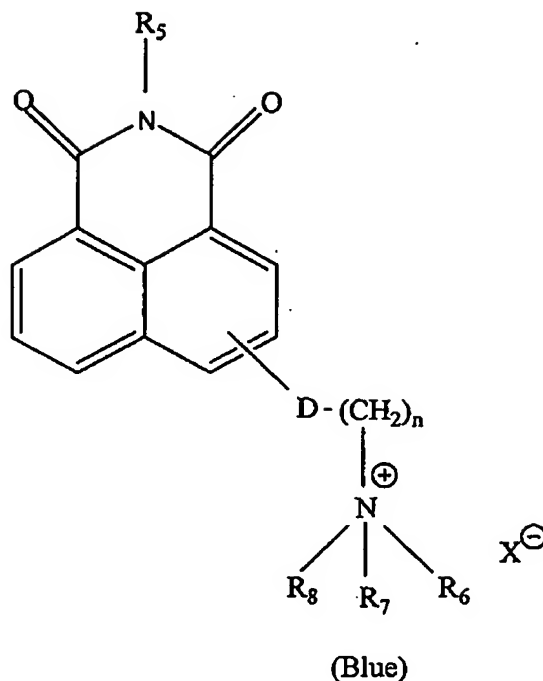
wherein $a + v + f + c = 100$;

- i) using a fluorometer to detect the fluorescent signal of said tagged treatment polymer;
- ii) converting the fluorescent signal of said tagged treatment polymer to the concentration of said tagged treatment polymer; and

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- iii) adjusting the concentration of said tagged treatment polymer according to what the desired concentration is for said tagged treatment polymer in said industrial water system.
19. (Withdrawn) The method of Claim 18 wherein Q is acrylic acid and W is acrylamide.
20. (Withdrawn) The method of Claim 18 wherein Q is acrylamide, W is acrylic acid and S is N-sulfomethylacrylamide.
21. (Withdrawn) The method of Claim 18 wherein Q is acrylic acid and W is acrylamidomethylpropane sulfonic acid.
22. (Withdrawn) The method of Claim 18 wherein G is N-allyl-4-(2-N',N'-dimethylaminoethoxy)naphthalimide, methyl sulfate quaternary salt, Q is acrylic acid, W is acrylamide and S is N-sulfomethylacrylamide.
23. (Withdrawn) The method of Claim 18 wherein said fluorescent monomer G is N-allyl-4-(2-N',N'-dimethylaminoethoxy)naphthalimide, methyl sulfate quaternary salt, Q is acrylic acid and W is acrylamidomethylpropane sulfonic acid.
24. (Withdrawn) The method of Claim 18 wherein said fluorescent monomer G is N-allyl-4-(2-N',N'-dimethylaminoethoxy)naphthalimide, methyl sulfate quaternary salt and Q is acrylic acid.
25. (Withdrawn) A method for maintaining the desired amount of tagged treatment polymer in an industrial water system comprising the steps of:
- a) adding an inert tracer and a tagged treatment polymer to the water of an industrial water system, wherein said tagged treatment polymer is selected from the group consisting of:
- (1) $G_a Q_j W_t$
- wherein G is selected from the group consisting of:

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wherein n is an integer, selected from the group consisting of 1-10;

R_6 and R_7 are alkyl;

R_8 is selected from the group consisting of allyl, alkyl, vinylbenzyl and 2-hydroxy-3-allyloxy-propyl;

R_5 is selected from the group consisting of alkyl, alkylamino, hydroxyalkyl, and allyl;

D is oxygen or nitrogen or sulfur or nonexistent; with the proviso that when D is nonexistent, $(CH_2)_n$ is bonded directly to a carbon on the ring; and

X is an anionic counter ion;

wherein Q is selected from the group consisting of acrylic acid and salts thereof, methacrylic acid and salts thereof, maleic acid and salts thereof, maleic anhydride, , acrylamide, crotonic acid, acrylamidomethylpropane sulfonic acid and salts thereof;

wherein W is selected from the group consisting of:

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acrylic acid and salts thereof, methacrylic acid and salts thereof, itaconic acid and salts thereof, maleic acid and salts thereof, maleic anhydride, crotonic acid and salts thereof, acrylamide, methacrylamide, vinyl sulfonic acid, styrene sulfonate, N-tertbutylacrylamide, N-isopropylacrylamide, butoxymethylacrylamide, N,N-dimethylacrylamide, N,N-diethylacrylamide, dimethylaminoethyl acrylate methyl chloride quaternary salts, dimethylaminoethyl acrylate benzyl chloride quaternary salts, dimethylaminoethyl acrylate methyl sulfate quaternary salt, dimethylaminoethyl methacrylate methyl sulfate quaternary salt, dimethylaminoethyl acrylamide methyl sulfate quaternary salts, dimethylaminopropyl acrylamide methyl sulfate quaternary salts, dimethylaminopropyl methacrylamide methyl sulfate quaternary salts, diallyldimethyl ammonium chloride, N-vinyl formamide, dimethylamino ethyl methacrylate acid salts (including, but not limited to, sulfuric acid and hydrochloride acid salts), dimethylaminoethyl methacrylate methyl chloride quaternary salt, dimethylaminoethyl methacrylate benzyl chloride quaternary salt, methacrylamidopropyl trimethyl ammonium chloride, acrylamidopropyl trimethyl ammonium chloride, methylene bis acrylamide, triallylamine, acid salts of triallylamine, ethylene glycol dimethacrylate, hydroxymethylacrylate, hydroxyethylacrylate, hydroxypropylacrylate, hydroxypropylmethacrylate, diethylene glycol dimethacrylate, triethylene glycol dimethylacrylate, polyethylene glycol dimethacrylate, glycidyl methacrylate, acrylamidomethylpropane sulfonic acid and the sodium salt thereof, vinyl alcohol, vinyl acetate, and N-vinylpyrrolidone;

with the proviso that Q and W cannot both be the same;

wherein a is from about 0.001 to about 10.0 mole percent;

wherein j is from about 0 to about 99.999 mole percent;

wherein t is from about 0 to about 99.999 mole percent; and

wherein $a + j + t = 100$;

(2) $G_a Q_v W_t S_c$

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wherein G is as previously defined;

wherein Q is as previously defined;

wherein W is as previously defined, with the proviso that Q and W
cannot both be the same;

wherein S is selected from the group consisting of sulfomethylacrylamide and
sulfoethylacrylamide;

wherein a is from about 0.001 to about 10.00 mole percent;

wherein v is from about 0 to about 97.999 mole percent;

wherein f is from about 1 to about 97.999 mole percent;

wherein c is from about 1 to about 40 mole percent; and

wherein $a + v + f + c = 100$;

such that a desired concentration of said tagged treatment polymer is
present in said water;

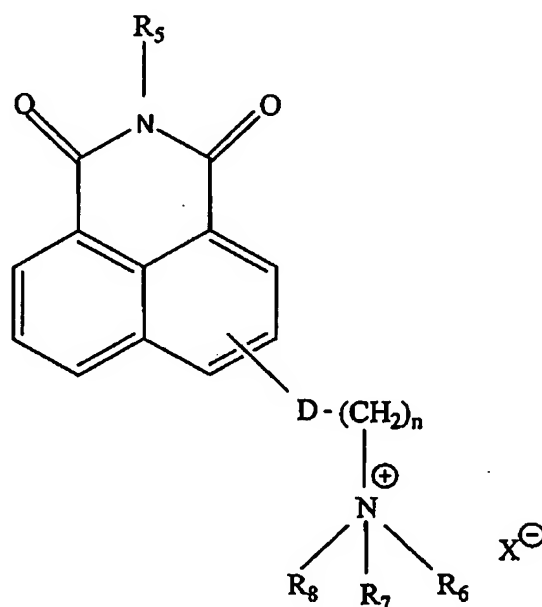
- b) using a fluorometer to detect the fluorescent signals of said inert tracer and
said tagged treatment polymer;
- c) converting the fluorescent signals of said
inert tracer and said tagged treatment polymer to the concentration of said
inert tracer and said tagged treatment polymer; and
- d) adjusting the concentration of said tagged treatment polymer according to
what the desired concentration is for said tagged treatment polymer in said
industrial water system.

26. (Withdrawn) The method of Claim 25 wherein Q is acrylic acid and W is acrylamide.

27. (Withdrawn) The method of Claim 25 wherein Q is acrylamide, W is acrylic acid and S is
N-sulfomethyl acrylamide.

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28. (Withdrawn) The method of Claim 25 wherein Q is acrylic acid and W is acrylamidomethylpropane sulfonic acid.
29. (Withdrawn) The method of Claim 25 wherein G is N-allyl-4-(2-N',N'-dimethylaminoethoxy)naphthalimide, methyl sulfate quaternary salt, Q is acrylic acid, W is acrylamide and S is N-sulfomethylacrylamide.
30. (Withdrawn) The method of Claim 25 wherein G is N-allyl-4-(2-N',N'-dimethylaminoethoxy)naphthalimide, methyl sulfate quaternary salt, Q is acrylic acid and W is acrylamidomethylpropane sulfonic acid.
31. (Withdrawn) The method of Claim 25 wherein G is N-allyl-4-(2-N',N'-dimethylaminoethoxy)naphthalimide, methyl sulfate quaternary salt and Q is acrylic acid.
32. (Cancelled?) A water-soluble fluorescent monomer that contains at least one vinyl group and at least one quaternary amine group in the molecule, which is capable of free radical polymerization selected from the group consisting of compounds of the formulae:



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(Blue)

wherein n is an integer, selected from the group consisting of 1-10;

R₆ and R₇ are alkyl;

R₈ is selected from the group consisting of allyl, alkyl, vinylbenzyl and 2-hydroxy-3-allyloxy-propyl;

R₅ is allyl;

D is oxygen or nitrogen or sulfur or nonexistent; with the proviso that when D is nonexistent, (CH₂)_n is bonded directly to a carbon on the ring; and

X is an anionic counter ion.